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Linda
10/29/01

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October 29, 2001

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Mr. Richard A. Albright, Director
Office of Waste and Chemical Management
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Subject: Response to Notice of Deficiency – Section 6.6, Pond 18 Closure Plan, Astaris Idaho LLC. EPA ID No. IDD 07092 9518

Dear Mr. Albright:

This letter and attachments provide FMC's response to the Notice of Deficiency (NOD) – Section 6.6, Pond 18 Closure Plan, Astaris Idaho LLC, EPA ID No. IDD 07092 9518 received on September 27, 2001. Attachments 1 and 2 respond to the two specific items in the NOD: 1) explanation of the schedule for phase 1 of the closure of Pond 18 Cell A; and, 2) justification of the proposed use of Pond 18 Cell B for transfer of Pond 18 Cell A decant water, respectively. Attachment 3 provides an updated evaluation of the Pond 18 emissions during the closure period.

As you know, Astaris recently announced that phosphorus production will cease at the Pocatello plant no later than the end of this year. Despite this announcement, FMC remains committed to the closure schedule and procedures detailed in the Pond 18 Closure Plan. As described in Attachment 1, the proposed schedule for implementation of the initial fill (Phase 1) at Pond 18 Cell A does not include or contemplate any delays. The proposed schedule is virtually identical to the schedules proposed and executed for the initial fill phase at other RCRA ponds at the facility; however, there are some unique work elements that must be completed prior to initiating placement of the initial fill on Pond 18 Cell A.

Contrary to what is stated in the NOD the closure plan does not request continued operation of Pond 18 until dewatering of Cell A is completed. The dewatering activities are discussed at Attachment 2. The closure plan proposes that water will be transferred within the waste management unit (WMU), from Cell A to Cell B, and then removed from the WMU. With respect to the management of water after removal from the WMU, the closure plan states that "The water in Cell B will be removed and routed to the plant for reuse as process water (ICW), sent directly to the LDR treatment plant, or otherwise managed in accordance with RCRA requirements." Since water reuse as ICW and management through the LDR system are no longer viable options due to the announcement of plant shutdown, FMC is evaluating on-site water treatment options to manage water from the Pond 17 and 18 closures. As discussed in Attachment 2 and shown on Table 2-1, the primary volume of water that needs to be treated are those generated during the proposed 2002 initial fill phase of closure of each of these WMUs. Critical to the design of treatment systems is the design criterion for flow throughput of the treatment plant or the equalized (average) flow rate.

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In order to equalize flows from the ponds through the treatment plant during the closure period, Pond 17 water will be the top priority for treatment during 2002 while water from Pond 18 Cell A is transferred to Cell B. During the following year, 2003, water will be removed at relatively uniform rates from both Ponds 17 and 18. During 2004, the remaining volume is expected to be removed from Pond 18.

Certain procedures described in the Pond 18 closure plan were developed specifically to address EPA's concern regarding continued monitoring and minimizing potential emissions from Pond 18. The closure plan calls for continued operation of the FTIR system on Cell B and an interim contingent gas extraction system under the temporary cover at Cell A. Attachment 3 provides a revised pond emission study for Cell B during the Pond 18 closure period. As described in the study, the gas flux factors derived from Pond 16S were used for this evaluation. This is conservative because flux chamber results for recent Cell B decant water (ICW) indicate that this water has lower gas generation potential than that determined for Pond 16S. As a result the revised emission study significantly overestimates potential phosphine and hydrogen cyanide emissions from Cell B during the closure period. Even using the Pond 16S flux rates, the estimated emissions during the Pond 18 closure period are much lower compared to the 5-year dredging schedule formerly required under the RCRA Consent Decree.

Please feel free to contact me at (208) 236-8658 should you have questions regarding this information.

Very truly yours,

Rob J. Hartman

Rob J. Hartman
FMC Corporation

Attachments

cc: Andrew Boyd, EPA w/o attachments
Linda Meyer, EPA w/ attachments (2 copies)
Susan Hanson, Shoshone-Bannock Tribes w/ attachments
Jeanette Wolfley, Shoshone-Bannock Tribes w/ attachments
Chairman, Shoshone-Bannock Tribes Business Council w/ attachments

ATTACHMENT 1. Pond 18 Closure Schedule

In the Notice of Deficiency for Section 6.6 of the Pond 18 Closure Plan, the EPA requested FMC/Astaris to provide a detailed closure schedule and a justification for why the closure will, of necessity, take longer than the 180 days allowed for under 40 C.F.R. 265.113(b) (EPA letter dated September 21, 2001). The EPA also specifically requested an explanation for the delayed initiation of work to prepare the pond for phase 1 of closure. This document addresses those requests.

The proposed schedule for implementation of the initial fill (Phase 1) at Pond 18 Cell A does not include or contemplate any delays. The proposed schedule is virtually identical to the schedules proposed and executed for the initial fill phase at other RCRA ponds at the facility; however, there are some unique work elements that must be completed prior to initiating placement of the initial fill on Pond 18 Cell A. Additional details on the proposed schedule are provided below.

In the Pond 18 Closure Plan, Astaris proposes to close Cell A of the waste unit in the same general three-phase schedule proposed and successfully implemented for closure of other RCRA ponds at the Pocatello plant. Phase I is the placement of an initial fill to consolidate the pond solids, and install the temporary cover. Phase II, referred to in Table 6-1 of the Closure Plan as "the ponds solids consolidation period", represents the period required for the rate of consolidation of the pond solids to slow to an acceptable level of one inch per year. Based upon engineering analyses and experience with other ponds at the facility, this period is anticipated to last at least one and possibly as many as three years. During this period, activities will consist of the monitoring of settlement and quarterly reporting to the EPA, water removal via the installed dewatering system, and inspection and any needed maintenance of the interim cover and its components. Phase III is the construction of the final cap for Cell A.

The timing of the fieldwork associated with Phases I and III is influenced by the potential for severe weather at the site. This results in a practical construction season that typically runs from late April to the end of October. To avoid disruptions in the work, and based on the required duration of each of theses activities, Phase I, and Phase III work are each completed during a single construction season.

Astaris intends to perform the Phase I work for the closure of Pond 18, Cell A, during the 2002 construction season. The Phase III work is planned during the first full construction season after the consolidation of the pond solids has reached the acceptable level for final cap construction. This approach and schedule is fully consistent with the previously approved and executed pond closure initial fills and final cover construction at the Astaris facility.

The duration of various initial fill activities, when compared to prior years and other ponds, is not strictly proportional to relative pond areas. Rather, the duration is dependent on the volume of fill material that is required to complete the initial fill up to the design elevation for the temporary cover. Pond 18, Cell A, anticipated to be only half full of sediments at the initiation of closure, will require a significantly greater depth of fill than ponds that were completely full (e.g., Ponds 16S). Additionally, there are several schedule items in the initial fill process for which the duration is completely independent of the pond size. These include general mobilization, assembly and testing of the Super Span conveyor system (used for placing the initial layers of sand on the geotextile) and most of the dewatering system - mechanical and instrumentation construction.

Pending EPA's approval, Astaris will initiate and complete without delay the initial fill phase of closure during the 2002 construction season. In order to meet this schedule, Astaris has already initiated planning activities. Specifically, Astaris has begun the Phase I detail design work and has initiated the pricing and quotation phase of the procurement process for the long lead-time elements. The primary long lead-time elements are the high strength geotextile, which has a minimum delivery lead time of 8 weeks following issuing of the purchase order, and the conveyor system for sand placement, which has a lead time of 16 weeks. The already initiated detail design work consists of all the initial fill elements including the bird netting removal and support structure modification to allow Cell B netting to remain in place.

Mobilization for fieldwork cannot occur until after the end of the winter weather period and is planned for the last week of March 2002. Although the detailed construction schedule will be finalized by the construction contractor following contract award, the preliminary engineer's schedule indicates that following the March 2002 mobilization, the site preparation activities, which include support structure modification of the bird netting over Pond 18, Cell B, removal of the bird netting and other obstructions at Cell A, and widening of the dikes to support fill placement operations, will require approximately 7 weeks and will be completed by early May of 2002.

Preparation and placement of the geotextile will then follow and will take two weeks to complete. Once the geotextile has been placed, the top of the widened dike will be accessible for assembly of the Super Span conveyor system. Assembly and testing of the Super Span is anticipated to take four weeks to complete. Placement of the initial fill (sand, geogrid and slag) would then begin and continue for an estimated eleven weeks. This would be followed by the placement of the HDPE temporary liner system, including the bedding and settlement monuments, over a three-week period. Finally, about one month will be required to complete the installation of the dewatering and control system. Thus, from mobilization through completion of the initial fill phase, the schedule contemplates a total of approximately 31 to 32 weeks. Therefore Astaris anticipates that the Phase 1 of the Pond 18, Cell A closure will be completed on or before October 31, 2002. This schedule assumes EPA approval of the initial fill by December 15, 2001.

ATTACHMENT 2. Pond 18 Closure Water Management

In the Notice of Deficiency for Section 6.6 of the Pond 18 Closure Plan, the EPA requested FMC/Astaris to provide a justification for the proposed use of Pond 18 Cell B for the discharge of decant water from Pond 18 Cell A. EPA requested information on a detailed water balance for the production plant, calciner, and LDR waste treatment system, including losses through evaporation and pond leakage. This document addresses those requests.

Astaris recently announced that phosphorus production will cease at the Pocatello plant no later than the end of this year. Therefore, water reuse as process water (ICW) and management through the LDR system are no longer viable options and a water balance for the plant is no longer relevant. As stated in the closure plan, "The water in Cell B will be removed and routed to the plant for reuse as process water (ICW), sent directly to the LDR treatment plant, or otherwise managed in accordance with RCRA requirements." FMC is now evaluating other management options for water from the Pond 18 and 17 closures as described below.

A water balance for pond closures, based on current estimates of water in Pond 18 Cells A and B, Pond 17 and residual consolidation dewatering from other RCRA ponds in closure, is provided on attached Table 2-1. Table 2-1 includes estimated precipitation and evaporation effects on the total volume of water in storage. Table 2-1 does not include an estimate for leakage into the LCDRS system at Pond 18. Since Pond 18 began operation in November 1998 through October 2001, a total of 285 gallons of water has been pumped from the LCDRS system which would not materially affect the volumes estimated in the Table 2-1 water balance for Pond 18. In addition, based on laboratory analysis of the water pumped from the LCDRS, the water is likely condensation of moisture in the LCDRS rather than leakage of pond water.

The primary volumes of water that need to be managed are those generated during the proposed 2002 initial fill phase of closure of Ponds 17 and 18 Cell A. Critical to the design of water treatment systems is the design criterion for flow throughput of the treatment plant or the equalized (average) flow rate. The column titled "Net Water Removed from Ponds" on Table 2-1 shows an estimated average flow of decant from the ponds of approximately 0.90 million gallons per month. Note that during June and July 2002, a significant additional flow from the initial fill phase at Pond 17 will need to be managed above the estimated average flow from all ponds. In order to equalize flows from the ponds through the treatment plant during the closure period, Pond 17 water will be the top priority for treatment during 2002 while water from Pond 18 Cell A is transferred to Cell B. During the following year, 2003, water will be removed at relatively uniform rates from both Ponds 17 and 18. During 2004, the remaining volume is expected to be removed from Pond 18.

Based on the gross volume of water that will be removed during the pond closures, placing the water into rail cars or other containers and shipping the water to an off-site disposal facility is not likely to be feasible. The total estimated volume would require over 1,600 railcars and it is unclear that off-site treatment capabilities exist to manage this volume of water. Therefore, FMC has retained a consultant with expertise in wastewater treatment system design and operation and has begun conceptual design of a wastewater treatment system to manage pond closure decant water. Preliminary options for discharge of the treated wastewater that have been identified include use as irrigation water, discharge to the Pocatello POTW, and discharge under a modified NPDES permit. FMC will provide EPA with additional details on wastewater treatment system design, discharge options and schedule as that information is developed. FMC plans to develop and permit the wastewater treatment system to be used for a variety of wastewaters that will be generated from several pond closures and from decommissioning of the process facilities. Since the treatment system would serve a number of wastewater streams, its design and any required permitting will be done independently and not in the context of any specific closure plan.

Table 2-1. Water Balance for Pond Closures (All values in Millions of Gallons)

Month	Rainfall	Evaporation	Pond 17 Dewatering			Pond 18 Cell A Dewatering (to Cell B)			Pond 18 Cell B		Other Ponds	Change in	Total Stored	Net Water Removed
			Preliminary	Initial Fill	Long Term	Preliminary	Initial Fill	Long Term	Dewatering	Closure	Dewatering	storage	in Pond 18B	from Ponds
Jan-02	0.73	-0.23	0.00									0.49	12.39	
Feb-02	0.58	-0.31										0.27	12.66	
Mar-02	0.79	-0.52				0.65						0.92	13.58	
Apr-02	0.77	-0.88				0.65					0.16	0.54	14.12	0.16
May-02	0.88	-1.44				0.65					0.90	0.09	14.21	0.90
Jun-02 [1]	0.68	-1.08				0.28					0.45	-0.12	14.09	0.45
Jun-02 [1]	0.00	-1.08		1.63		0.37					0.00	-0.71	13.38	1.63
Jul-02 [1]	0.00	-0.75		1.06							0.00	-0.75	12.64	1.06
Jul-02 [1]	0.34	-0.75		1.92			2.50				0.00	2.09	14.72	1.92
Aug-02	0.41	-1.47		0.09	0.56						0.25	-1.06	13.67	0.90
Sep-02	0.26	-0.94			0.56						0.34	-0.68	12.99	0.90
Oct-02	0.31	-0.55			0.60						0.30	-0.24	12.75	0.90
Nov-02	0.39	-0.24							-0.90			-0.75	11.99	0.90
Dec-02	0.36	-0.11							0.00			0.25	12.25	0.00
2002 Total	**6.50**	**-10.35**	**0.00**	**4.70**	**1.72**	**2.60**	**2.50**	**0.00**	**-0.90**	**0.00**	**2.40**	**0.35**		9.72
Jan-03	0.39	-0.11							0.00			0.27	12.52	0.00
Feb-03	0.31	-0.15							0.00			0.16	12.68	0.00
Mar-03	0.42	-0.25							0.00			0.17	12.85	0.00
Apr-03	0.41	-0.42			0.43			0.47	-0.47			-0.01	12.84	0.90
May-03	0.47	-0.69			0.43			0.47	-0.47			-0.22	12.61	0.90
Jun-03	0.36	-1.03			0.43			0.47	-0.47			-0.67	11.94	0.90
Jul-03	0.18	-1.50			0.43			0.47	-0.47			-1.32	10.62	0.90
Aug-03	0.22	-1.47			0.43			0.47	-0.47			-1.25	9.37	0.90
Sep-03	0.26	-0.94			0.43			0.47	-0.47			-0.68	8.69	0.90
Oct-03	0.31	-0.55			0.43			0.47	-0.47			-0.24	8.45	0.90
Nov-03	0.39	-0.24							-0.90			-0.75	7.70	0.90
Dec-03	0.36	-0.11							0.00			0.25	7.95	0.00
2003 Total	**4.07**	**-7.47**	**0.00**	**0.00**	**3.00**	**0**	**0.00**	**3.30**	**-4.20**	**0.00**	**0.00**	**-4.29**		7.20
Jan-04	0.39	-0.11							0.00			0.27	8.23	0.00
Feb-04	0.31	-0.15							0.00			0.16	8.39	0.00
Mar-04	0.42	-0.25							0.00			0.17	8.55	0.00
Apr-04	0.41	-0.42							-0.90			-0.91	7.64	0.90
May-04	0.47	-0.69							-0.90			-1.12	6.52	0.90
Jun-04	0.36	-1.03							-0.90			-1.57	4.95	0.90
Jul-04	0.18	-1.50							-0.90			-2.22	2.73	0.90
Aug-04	0.22	-1.47							-0.90			-2.15	0.58	0.90
Sep-04	0.26	-0.94							-0.58			-1.26	-0.68	0.58
Oct-04	0.31	-0.55										-0.24	-0.92	0.00
Nov-04	0.39	-0.24										0.15	-0.78	0.00
Dec-04	0.36	-0.11										0.25	-0.52	0.00
2004 Total	**4.07**	**-7.47**	**0.00**	**0.00**	**0.00**	**0**	**0.00**	**0.00**	**-5.08**	**0.00**	**0.00**	**-8.47**		5.08
3 yr Total	**14.64**	**-25.29**	**0.00**	**4.70**	**4.72**	**2.60**	**2.50**	**3.30**	**-10.18**	**0.00**	**2.40**	**-12.42**		22.00

Notes:

1. June 2002 is split into two pieces to reflect that placement of the first 5' of fill in Pond 17 begins mid-month. Similarly, July 2002 is split to reflect placement of fill in Pond 18 Cell A.
2. Precipitation is for total areas of Ponds 17 and 18 thru August, 2002 and for only Pond 18 Cell B from September 2002 forward.
3. Evaporation is for water surface areas of Ponds 17 and 18 thru June, 2002 and for only Pond 18 Cell B from July 2002 forward.
4. Initial total stored is Pond 18, Cell B volume as of January1, 2002.
5. Average flow to water treatment plant from pond closures and dewatering is approx. 21 gpm (900,000 gal/month).
6. Water treatment plant cannot operate during winter months when Pond 18B will be frozen.
7. FMC permit to discharge sewage to the City of Pocatello treatment plant allows a maximum daily flow of 23.75 gpm (34,200 gal/day).

ATTACHMENT 3

PHOSPHINE AND HYDROGEN CYANIDE DISPERSION ASSESSMENT FOR POND 18 CELL B DURING ITS CLOSURE PERIOD

Contents

Phosphine And Hydrogen Cyanide Dispersion Assessment For Pond 18 Cell B During Its Closure Period

This study estimates the impact of phosphine and hydrogen cyanide emissions from Cell B of Pond 18 at the Astaris elemental phosphorus plant in Pocatello, Idaho during the Cell B closure period. Phosphine and hydrogen cyanide emission rate estimates for Cell B are described in Section 1. The results of a dispersion modeling study of these emissions, and a comparison with health-based assessment criteria are presented in Section 2. Procedures established under the FMC *RCRA Pond Management Plan* to protect workers, the public, and birds from pond emissions will continue in effect during the Cell B closure period, as discussed in Section 2.

1 PHOSPHINE AND HYDROGEN CYANIDE EMISSION RATES

Section 1.1 presents estimated phosphine emission rates from Cell B during the closure period. Estimated hydrogen cyanide emission rates from Cell B during this period are presented in Section 1.2.

1.1 Phosphine Emission Rates

Phosphine emission rates for two conditions were developed: the quiescent condition, during which pond sediments are not agitated, and the slurry removal condition, during which phosphine emissions could be increased above the quiescent condition through release of entrained phosphine gas. Two previous assessments of Pond 18 emissions (Bechtel 2000a and 2000b) discuss studies of phossy waste properties that led to the recognition of these conditions.

Quiescent Condition Emission Rate

As discussed in the *Pond 18 Emission Analysis* (Bechtel 2000a), the phosphine (PH_3) emission rate from a phossy waste pond is proportional to the mass of phossy waste sediment in the pond. In that study, the calculated phosphine emission rate from Pond 16S and the Pond 16S phossy waste sediment volume then present were used to derive a phosphine emission rate normalized to the mass of phossy waste sediment. This normalized rate was used to estimate the phosphine emission rate from Pond 18 at the start of the sediment reclamation process from Pond 18 (May 2002) required by provisions of the FMC RCRA Consent Decree then in force.

As also discussed in Bechtel (2000a), the phosphine emission rate from Pond 18 Cell A was assumed to be 90% of the overall Pond 18 emission rate, based on the pond design assumption that Cell A will contain 90% of the overall mass of phossy waste sediment discharged to Pond 18. Correspondingly, the phosphine emission rate from Cell B of Pond 18 was 10% of the overall pond emission rate.

This 2000 study was used to estimate phosphine emissions from Cell B of Pond 18 over the period from May 2002 to May 2005. Using the phosphine emission rate developed for Pond 16S (0.599 grams per second (g/s)) (Bechtel 2000a) and the mass of phossy waste sediment in Pond 16S at that time (125 acre-feet), the phosphine emission rate per acre-foot of sediment is:

$$(0.599 \text{ g/s}) / 125 \text{ acre-ft} = 4.79 \times 10^{-3} \text{ g/s per acre-ft.}$$

The maximum inventory of phossy waste sediment in Pond 18 by May 2002 is expected to be 24 acre-feet. Assuming that 10% of this inventory is contained in Cell B, the phosphine emission rate from Pond 18 Cell B is:

$$(4.79 \times 10^{-3} \text{ g/s/acre-ft}) (2.4 \text{ acre-ft}) = 1.15 \times 10^{-2} \text{ g/s.}$$

Given the area of Pond 18 Cell B (45,108 m^2), the phosphine flux rate from Cell B between May 2000 and initiation of removal of residual phossy waste sediments at the end of the Cell B reclamation period (estimated to be in April 2005) is:

$$(1.15 \times 10^{-2} \text{ g/s}) / (45{,}108 \text{ m}^2) = 2.549 \times 10^{-7} \text{ g/s-m}^2.$$

This Cell B emission rate corresponds to the condition during which phossy waste sediments are not mechanically agitated (i.e., a quiescent condition). Phosphine emissions during sediment removal are described in section 1.1.2.

Slurry Removal Emission Rate

Residual sediment will be removed from Pond 18 Cell B during the last month of the inventory-removal program by directing water sprays to flush residual sediments toward slurry pumps. As described in the Pond 18 emission assessments (Bechtel 2000a and 2000b), mechanical agitation of phossy waste sediments can result in an increased phosphine emission rate through the release of phosphine gas entrained in the sediments.

The uncontrolled emission factor for mixing phossy waste pond slurry (Bechtel 2000a) was estimated to be 0.07221 grams of phosphine per gallon of slurry. Assuming the removal of residual slurry from Cell B takes 4 weeks (5 days per week, 8-hours per day), the phosphine emission rate during slurry removal is estimated to be:

$$(0.07221 \text{ g } PH_3\text{/gal slurry}) \times (2.4 \text{ acre-ft} / (4 \text{ w} \times 5 \text{ d/w} \times 8 \text{ h/d})) \times (3.259 \times 10^{-5} \text{ gal/acre-ft}) \times (1 \text{ hr/3600 s}) = 9.81 \times 10^{-2} \text{ g/s}$$

Given the area of Pond 18 Cell B (45,108 m^2), the phosphine flux rate from Cell B during the 4-week slurry removal period (estimated to occur in April 2005) is:

$$(9.81 \times 10^{-2} \text{ g/s}) / (45{,}108 \text{ m}^2) = 2.175 \times 10^{-6} \text{ g/s-m}^2.$$

Conservative Basis of Phosphine Emission Rates

The estimated phosphine emission rates for Cell B described above likely overstate phosphine emissions during both the quiescent period and the slurry removal process for several reasons:

The assumption that Cell B contains 10% of the volume of phossy waste sediments discharged to Pond 18 was obtained from the design basis for Pond 18. This design basis assumed that the Pond 18 would receive 38 acre-feet of sediment, and that sediment accumulation in Cell B would primarily occur as Cell A sediment accumulation approached its final design volume. Due to reduced phossy waste generation, the final expected phossy waste sediment accumulation in Pond 18 is 24 acre-feet. Because sediment accumulation in Cell A has not approached its design volume, suspended solid overflow from Cell A to Cell B is likely much less than the assumed volume of 2.4 acre-feet used to derive Cell B emission rates.

Sediments in Cell B result from overflow of suspended sediments from Cell A and deposition of ambient dust on the cell's water surface. The sediments deposited in Cell A should contain a greater concentration of phosphine-emitting constituents (elemental phosphorus and metallic phosphides) than those that have accumulated in Cell B. Moreover, because the sediment blanket within Cell B is much thinner than in Cell A, it is less likely that Cell B sediments retain entrained phosphine gas.

A sample of Pond 18 Cell B decant water was tested in an isolation flux chamber to evaluate phosphine (and hydrogen cyanide) emission characteristics. Headspace gases were passed though closed cell FTIR to measure phosphine and hydrogen cyanide concentrations. As shown in Figure 1, phosphine was not detected in headspace gas from this sample. This further indicates that the phosphine emission rate for the quiescent period used in the dispersion modeling assessment overstates impact.

1.2 Hydrogen Cyanide Emission Rates

The hydrogen cyanide emission rate previously determined for Pond 18 as a whole using data from the FTIR system monitorng Pond 18 was 2.27 g/s (Bechtel 1999). Because hydrogen cyanide emissions are proprtional to the surface area of the source, rather than the mass of phossy waste sediments within each cell, the emission rates of hydrogen cyanide from Cell A and Cell B are based on the relative surface areas of each cell (Cell A = 13,955 m^2 and Cell B = 45,108 m^2). The estimated emission rate for Cell A and Cell B were thus 0.536 g/s and 1.734 g/s, respectively.

As discussed in Bechtel (2000b), the mass of cyanide in Cell B after the overflow pipe from Cell A is blocked was conservatively estimated to be approximately 71,000 pounds. This was based on the average total cyanide concentrations in Astaris waste streams (ranging from 730 mg/l in NOSAP slurry discharge from Tank V-3700; an average total cyanide concentration in V-3600 discharge of 109 mg/l; and several parts per million or less in pond decant water). Because Pond 18 has infrequently received off-spec NOSAP slurry, it was assumed that the average total cyanide concentration in Cell B water would be 250 mg/l (Bechtel 2000b). Given the anticipated volume of water in Cell B on May 26, 2002, of 100 acre-feet, the mass of cyanide dissolved in Cell B water was calculated as 70,557 pounds.

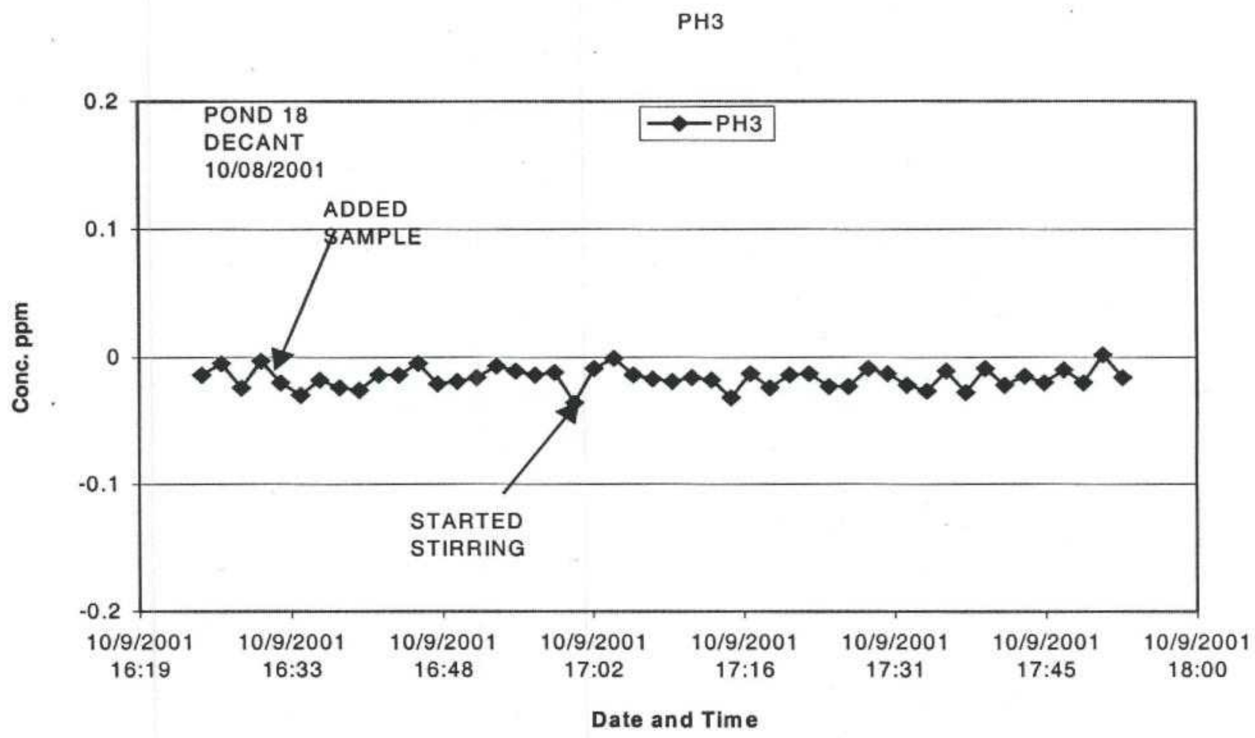

Figure 1
Isolation Flux Chamber Results for Phosphine in Cell B Decant

Were Cells A and B to be hydraulically isolated after May, 2002, the cyanide mass locked in Cell B would be depleted after 215 days through conversion to volatile hydrogen cyanide (Bechtel 2000b). However, approximately 1 million gallons of water from Cell A generated by the dewatering process after placement of the initial fill will be added to approximately 20 million gallons of water remaining in Cell B during 2003. Smaller volumes may also be transferred in 2004 and 2005. This transfer can renew the dissolved cyanide content of Cell B. However, this residual water should have a dissolved cyanide concentration comparable with the water in Cell B prior to its initial hydraulic isolation from Cell A in 2002. Thus it was conservatively assumed that hydrogen cyanide emissions from Cell B would continue at a rate of 1.734 g/s until completion of water removal from Cell B.

Given the area of Pond 18 Cell B (45,108 m^2), the hydrogen cyanide flux rate from Cell B during both the quiescent period and slurry removal period is:

$$(1.734 \text{ g/s}) / (45{,}108 \text{ m}^2) = 3.844 \times 10^{-5} \text{ g/s-m}^2.$$

Conservative Basis of Hydrogen Cyanide Emission Rates

The estimated hydrogen cyanide emission rate for Cell B described above likely overstates hydrogen cyanide emissions during the quiescent period, based on flux chamber measurements and analysis of Cell B decant water.

Flux Chamber Tests of Cell B Decant Water

A sample of Pond 18 Cell B decant water was tested in an isolation flux chamber to evaluate hydrogen cyanide emission characteristics. Headspace gases were passed though a closed cell FTIR to determine hydrogen cyanide concentrations. As shown in Figure 2, hydrogen cyanide was detected in headspace gas at a maximum concentration of approximately 1.3 ppm. This maximum concentration was used with the following flux chamber parameters (flow rate, sample area) to calculate an emission flux rate from this sample:

- Peak HCN concentration = 1.31 ppm
- Cell temperature = 25°C = 298°K
- Pressure = 560 mm Hg (torr) = (569 torr)(1 atm/760 torr) = 0.749 atm
- Air flow rate = 2 liters/min = (2 l/m) (1 m^3/1000 l)(1 min/60s) = 3.33×10^{-5} m^3/s
- Sample surface area = 8 inch diameter pan = 3.243×10^{-2} m^2.

The headspace HCN concentration of 1.31 ppm corresponds to 1,084 µg/m3 using the following conversion published by the Air Pollution Control Associations:

$\mu g/m^3 = (ppm)\ (40.87)\ (M)\ [(P/P_o)(T/T_o)]$, where

M = the molecular weight of hydrogen cyanide

P = test chamber pressure

P_o = standard pressure (1 atm)

T = test chamber temperature

T_0 = standard temperature (298° K)

The hydrogen cyanide emission rate within the flux chamber was calculated as follows:

Emission rate (g/s) = [flow rate (m^3/s)] [concentration (g/m^3)]

= (3.33×10^{-5} m^3/s)(1.084×10^{-3} g/m^3)

= 3.61×10^{-8} g/s

This emission rate was used to calculate the emission flux rate, which describes emissions normalized to the surface area of the source, as follows:

Flux rate = [(3.61×10^{-8} g/s)/(3.243×10^{-2} m^2)]

= 1.113×10^{-6} g/s-m^2

This flux rate is approximately 35 times lower than the emission flux rate used in the dispersion model to predict airborne hydrogen cyanide concentrations. Using this lower emission flux rate would result in a 35-fold decrease in predicted hydrogen cyanide concentrations.

Analysis of Cell B Decant Water

The sample of Cell B decant water was also analyzed for total cyanide concentration in accordance with Method LDR-CA-502 (Total Cyanide Analysis in Wastewater). The total cyanide concentration detected in this sample was 0.27 mg/l, which is 925 times less than the concentration estimated (250 mg/l) in the earlier emission characterization (Bechtel 2000b). The pH of the Cell B decant water was 5.8. These data are consistent with the low hydrogen cyanide emission rate calculated from the Cell B flux chamber data. They further indicate that the hydrogen cyanide emission rate for Cell B used in the dispersion modeling assessment overstates impact.

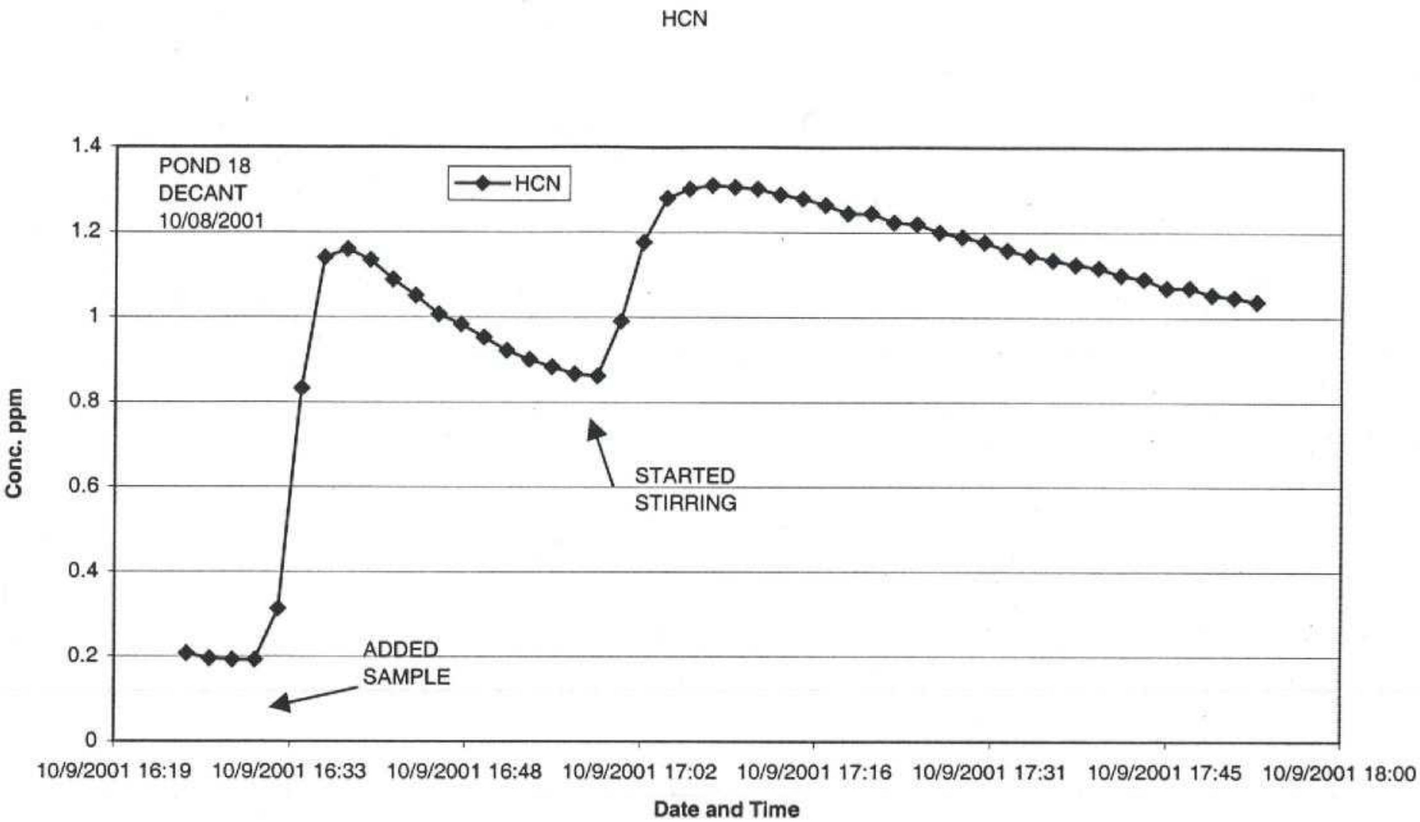

Figure 2
Isolation Flux Chamber Results for Hydrogen Cyanide in Cell B Decant

2 DISPERSION MODELING STUDY AND COMPARISON WITH HEALTH-BASED CRITERIA

2.1 Modeling Approach

The ISC3 short-term (version 00101) air dispersion model was used to predict maximum 1-hour, 4-hour, 8-hour, and annual average phosphine and hydrogen cyanide concentrations in ambient air attributable to emissions from Cell B during the closure period. ISC3 is an EPA-preferred model and is capable of:

- Simulating multiple-point and area sources.
- Utilizing site-specific hourly meteorological data as input.
- Performing dispersion calculations using rural dispersion coefficients (the Astaris modeling region is characterized as rural).

Emission sources considered during the Cell B closure period were the quiescent period (phosphine and hydrogen cyanide) and the 4-week slurry removal period toward the end of the closure process (phosphine). Phosphine and hydrogen cyanide emission rates for these conditions are presented in Section 1. Slurry removal during April 2005 was accounted for by modeling April's phosphine emission flux rate as 2.175×10^{-6} g/s-m^2; the remaining months were modeled with a phosphine emission flux rate of 2.549×10^{-7} g/s-m^2.

Meteorological data collected at FMC's (now Astaris') Pond Site Meteorological Station between January 1 and November 24, 1999, were used in the dispersion modeling study. To model emissions for a full year, meteorological data for the days of November 25 through November 30, 1999, were developed by using data for the previous six days. Meteorological data for December 1999 were represented by data from January 1999.

Meteorological data for the period May 27 through June 14, 1999, were not recorded. Data recorded for the period May 18 through May 26, 1999, were used to represent the first half of the set of missing records (i.e., May 27 through June 5, 1999). Data from the period June 15 through June 23, 1999, were used to represent the second half of the set of missing records (i.e., June 6 through 14, 1999). Data were missing for several other periods, ranging from 1 to 12 hours, on certain days during the year. Standard interpolation methods were used to fill in these data gaps. Installation and quality assurance audit reports for the FMC (now Astaris) Pond Meteorological Station are presented in Section 1 of Bechtel (2000b).

2.2 Modeling Results and Comparison with Health-Based Criteria

Figures 3 through 6 presents isopleth maps of the predicted maximum 1-hour, 4-hour, 8-hour and annual average phosphine concentrations during the Cell B closure period. Figures 7 through 10 presents isopleth maps of the predicted maximum 1-hour, 4-hour, 8-hour and annual average hydrogen cyanide concentrations during the Cell B closure period.

The predicted short-duration concentrations were compared with the OSHA permissible exposure limit (PEL), the federal Acute Exposure Guideline Levels 2 and 3 (AEGLs) for phosphine and hydrogen cyanide (EPA 2000a and b), and EPA's chronic exposure guidelines. The National Advisory Committee to develop AEGLs defines the AEGL-2 as the airborne concentration of a substance at or above which it is predicted that the general population, including susceptible but excluding hypersusceptible individuals, could experience irreversible or other serious, long-lasting effects or impaired ability to escape. AEGL-3 is the airborne concentration at or above which it is predicted that the general population, including susceptible but excluding hypersusceptible individuals, could experience life-threatening effects or depth. There are no AEGL Level 1 values for phosphine and hydrogen cyanide.

As shown in Tables 1 and 2, the maximum predicted short-term phosphine concentrations and hydrogen cyanide concentrations in ambient air are well-below these health-based criteria throughout the Cell B closure period. While the maximum annual average phosphine and hydrogen cyanide concentrations are greater than EPA's chronic exposure guidelines, as shown in Figures 6 and 10, the areal extent of such exceedence is confined to Astaris-owned and controlled property and the Highway 30 right-of-way immediately north of Cell B. There are no opportunities for chronic exposures in this area.

2.3 Continued Protections under the RCRA Pond Management Plan

Measures in place under the FMC *RCRA Pond Management Plan* (Bechtel 1998) will be continued during the Pond 18 Cell B closure period to protect workers, the public, and birds from phosphine and hydrogen cyanide emissions.

Work practices and administrative controls will prevent onsite worker risk during any work activities or inspections in the vicinity of Pond 18. Access to the Pond 18 area will be limited by security fencing. Bird netting already in place will continue to serve as an avian deterrence throughout the Cell B closure period.

RCRA Pond Management Plan procedures for phosphine monitoring and response (at the pond perimeter, facility fenceline, and Highway 30) will continue in effect throughout the Pond 18 Cell B closure period. These phosphine monitoring and response criteria are also protective for hydrogen cyanide emissions. The existing open-path FTIR monitoring system that continuously monitors phosphine and hydrogen concentrations along the Pond 18 berm will remain in use throughout the Cell B closure period.

As previously discussed, the emission rates used in this assessment are very conservative and actual phosphine and hydrogen cyanide concentrations experienced during the Cell B closure period should be less than calculated. Even so, these conservatively-based predicted impacts are well below the threshold concentrations established under Section 3.3 of the *RCRA Pond Management Plan* that identify the need for response actions to limit worker exposure in the vicinity of Pond 18 and public access along and north of Highway 30.

Figure 3. Maximum 1-Hour Average PH3 Concentrations (Pond 18 Cell B Emissions)

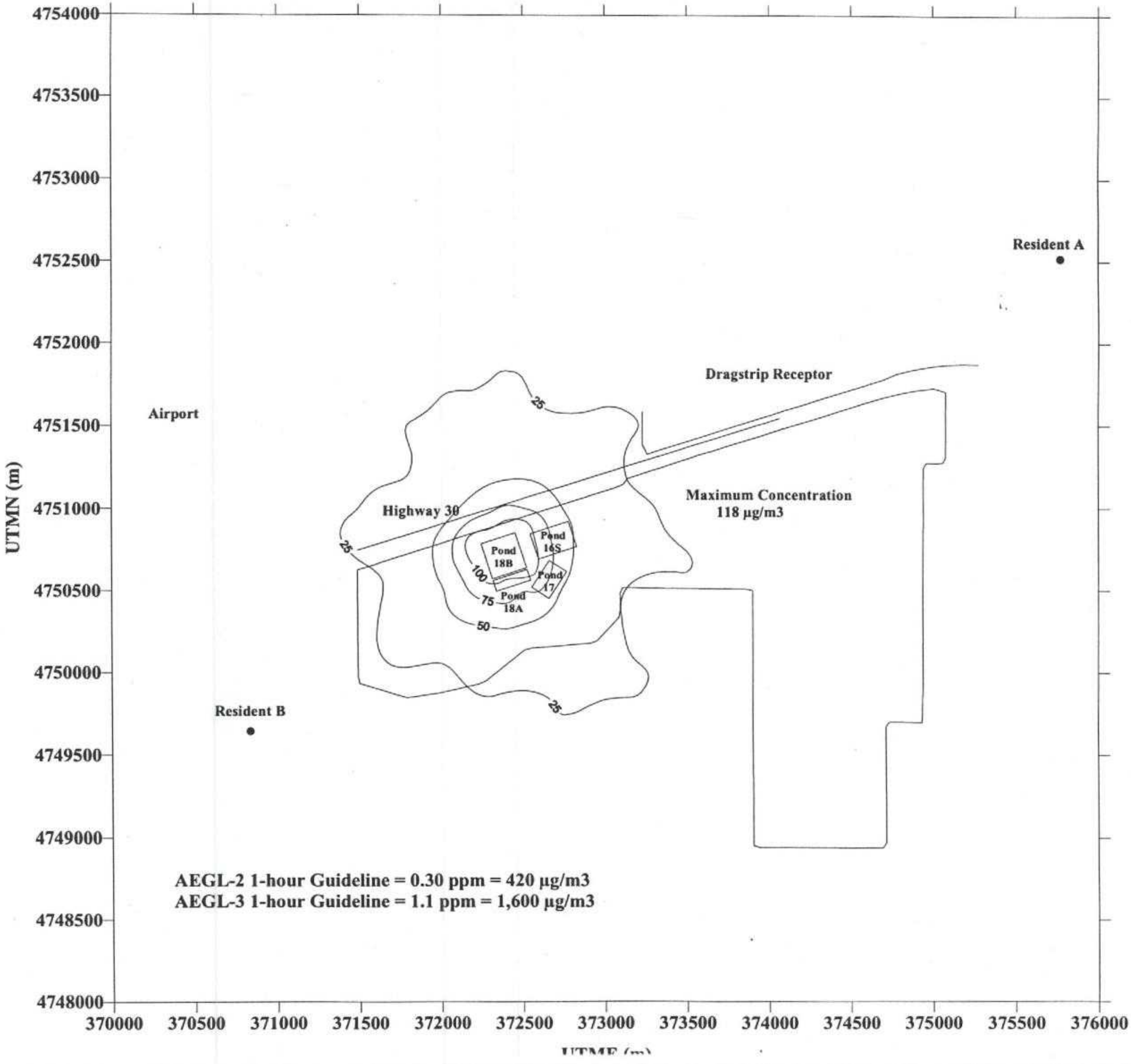

Figure 4. Maximum 4-Hour Average PH3 Concentrations (Pond 18 Cell B Emissions)

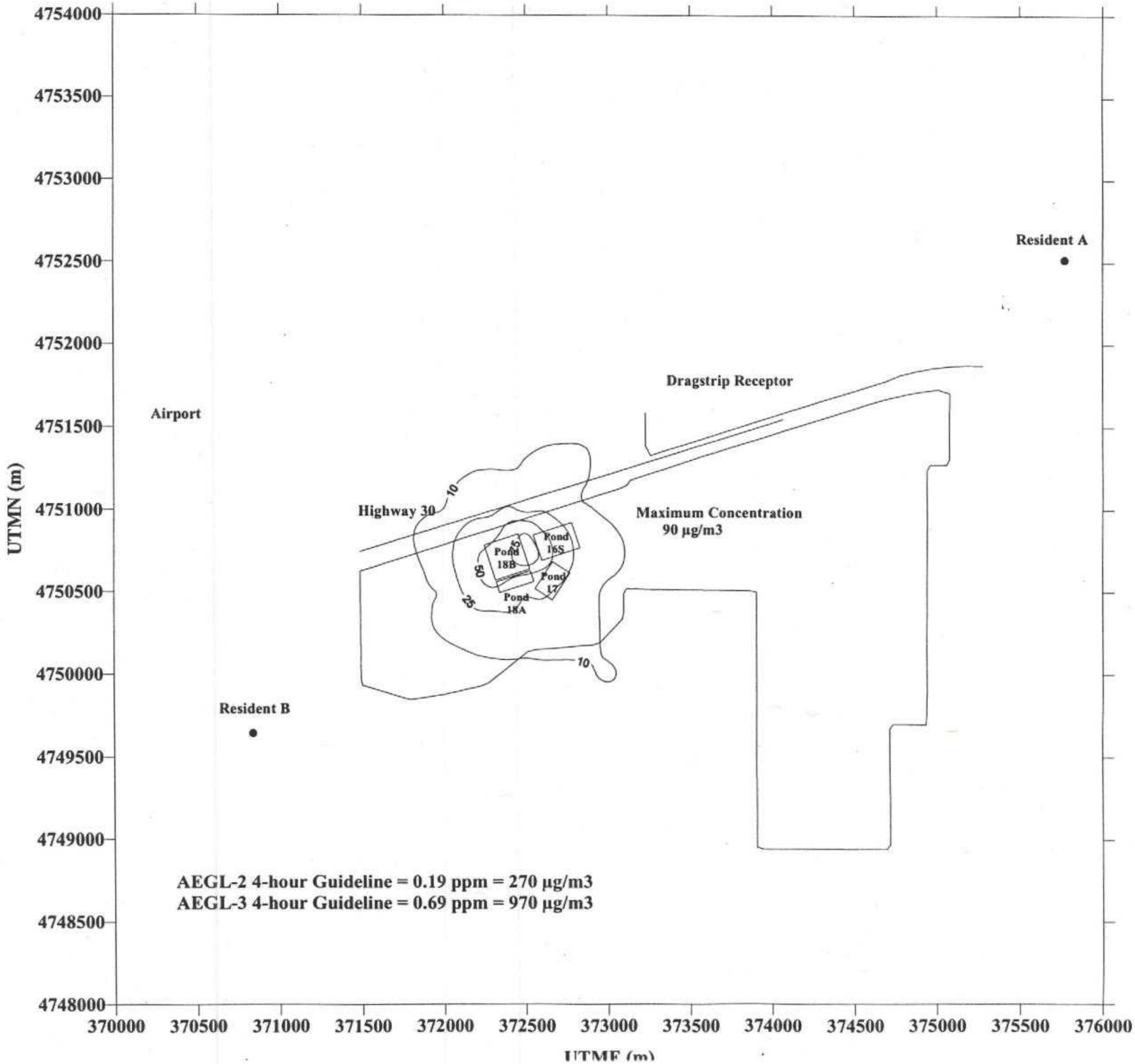

Figure 5. Maximum 8-Hour Average PH3 Concentrations (Pond 18 Cell B Emissions)

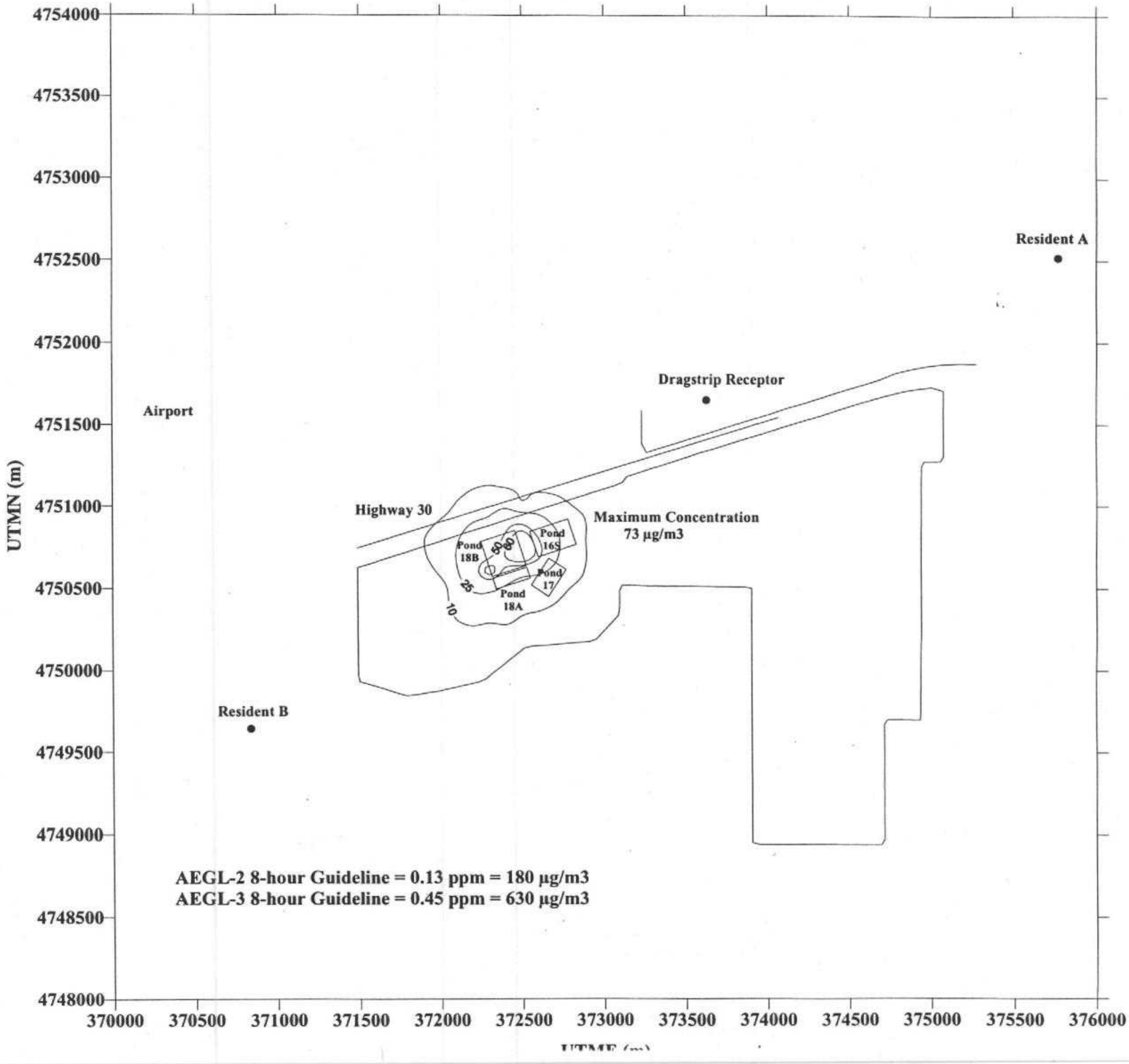

Figure 6. Annual Average PH3 Concentrations (Pond 18 Cell B Emissions)

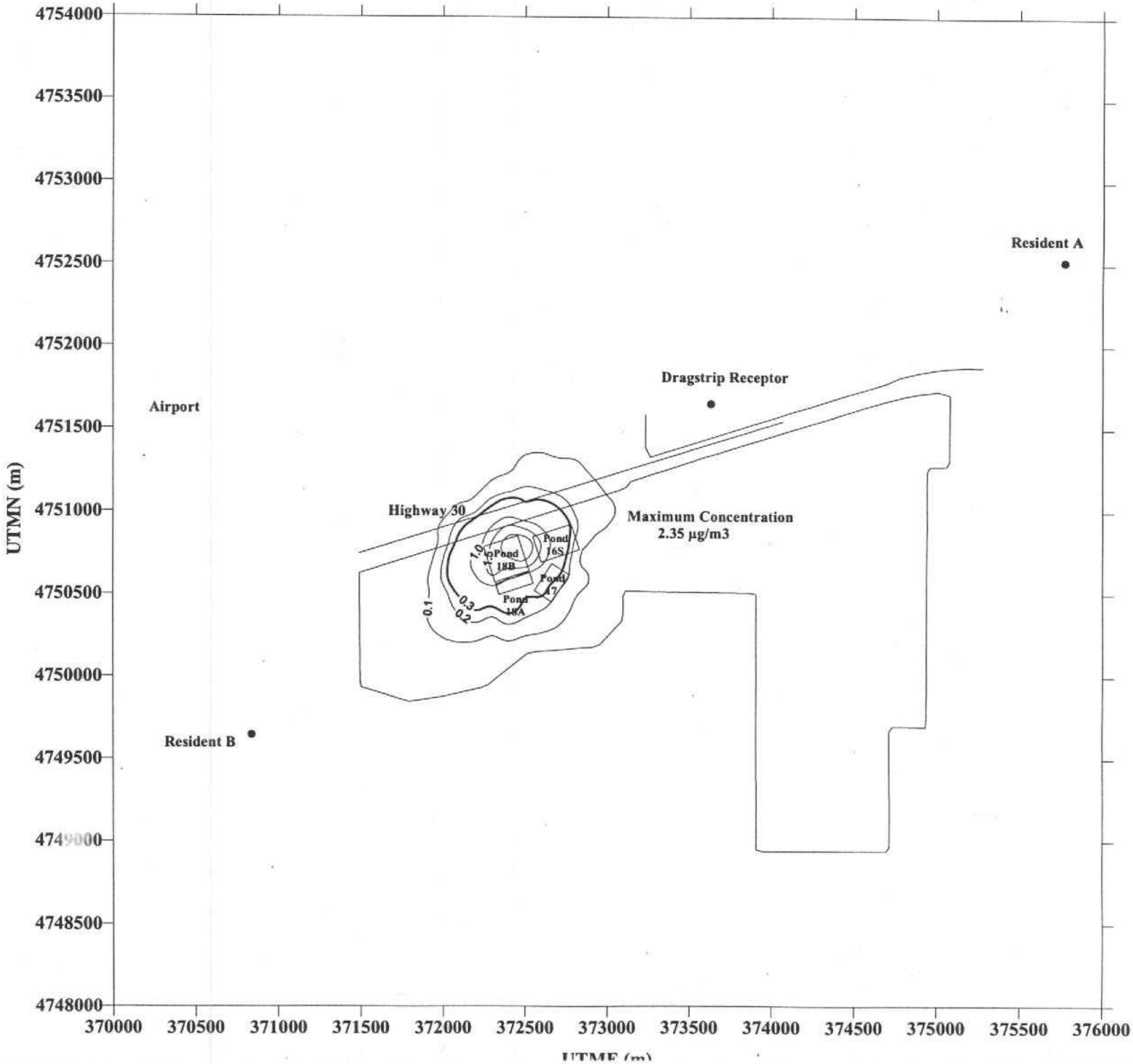

Figure 7. Maximum 1-Hour Average HCN Concentrations (Pond 18 Cell B Emissions)

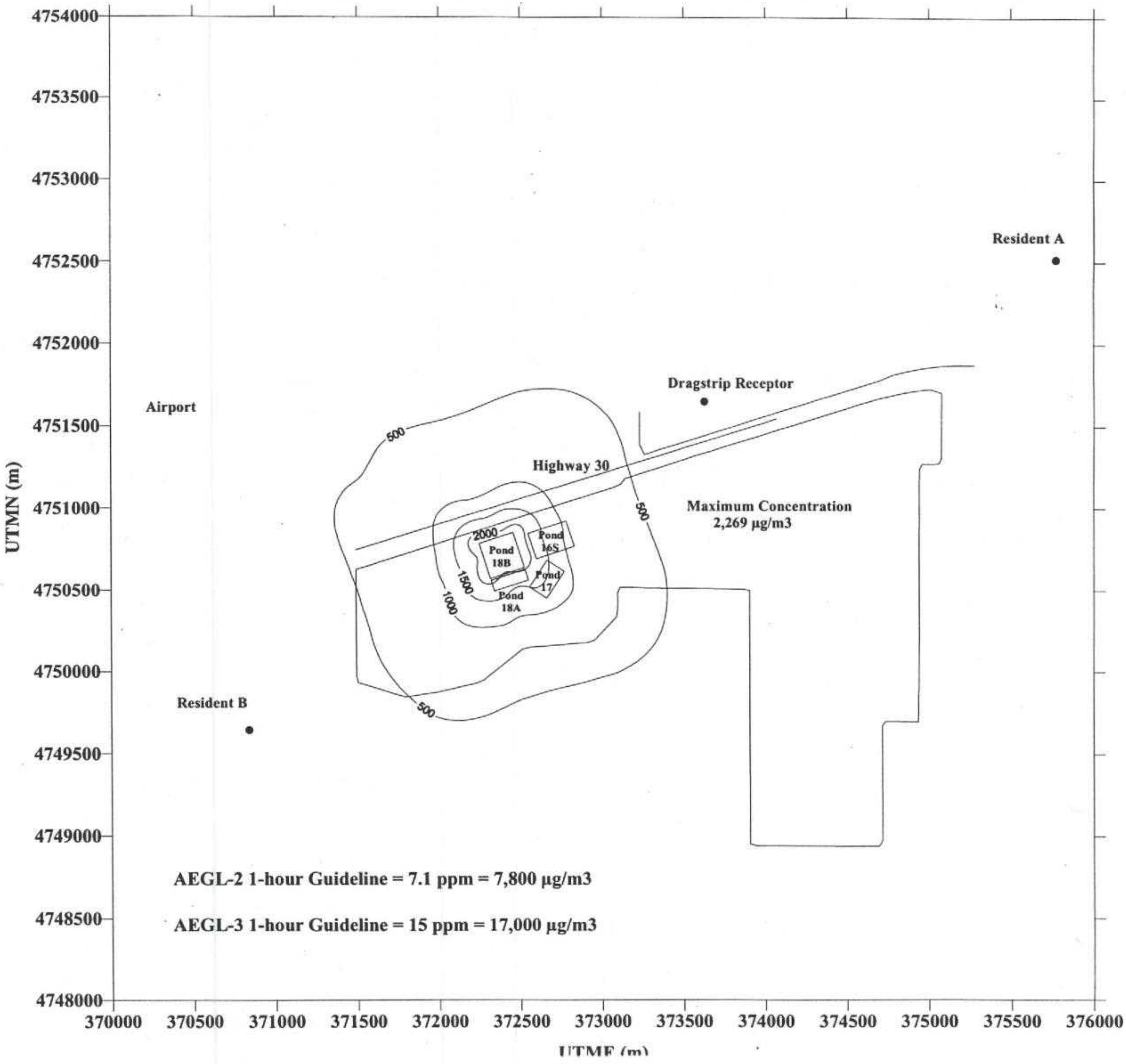

Figure 8. Maximum 4-Hour Average HCN Concentrations (Pond 18 Cell B Emissions)

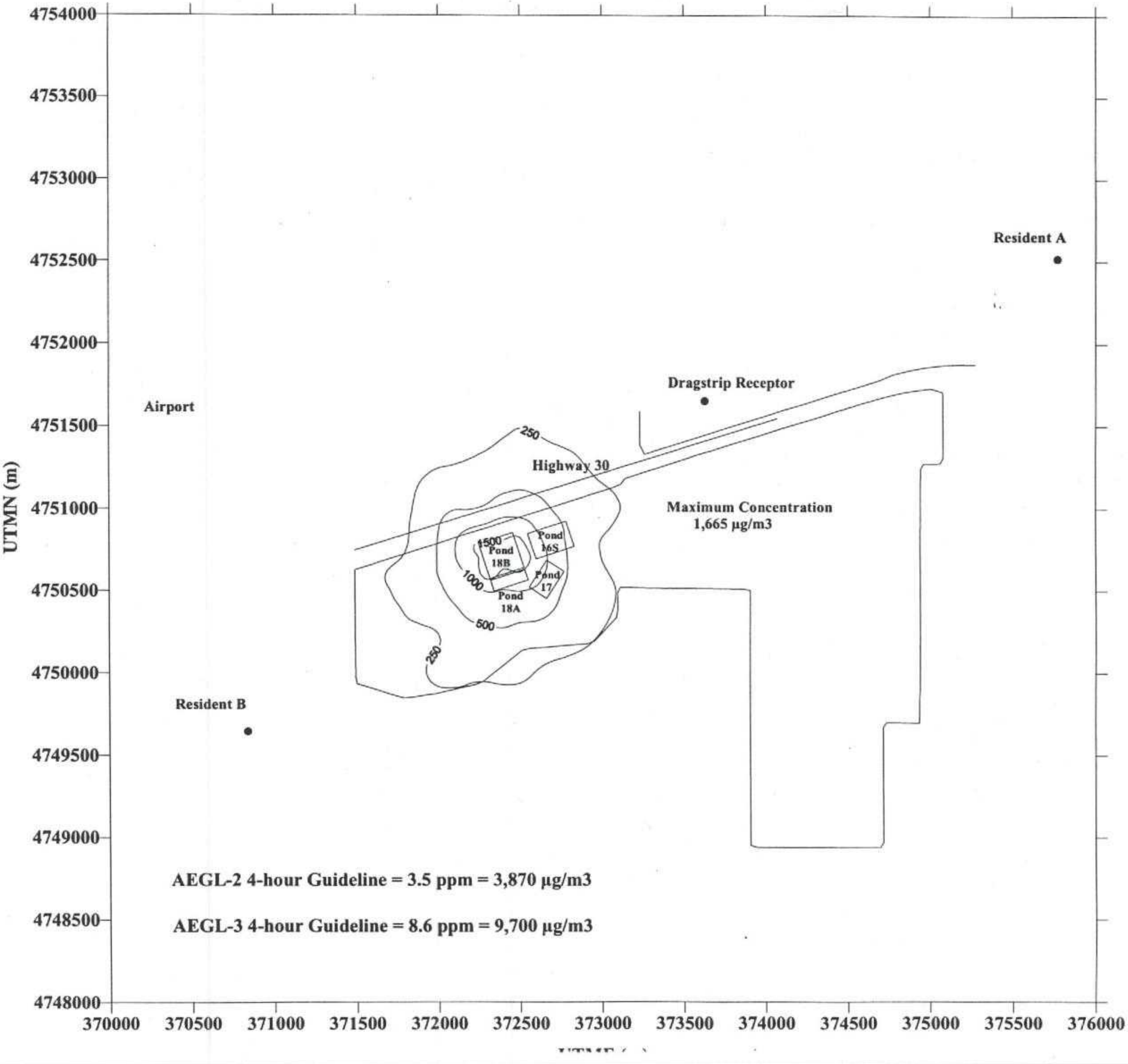

Figure 9. Maximum 8-Hour Average HCN Concentrations (Pond 18 Cell B Emissions)

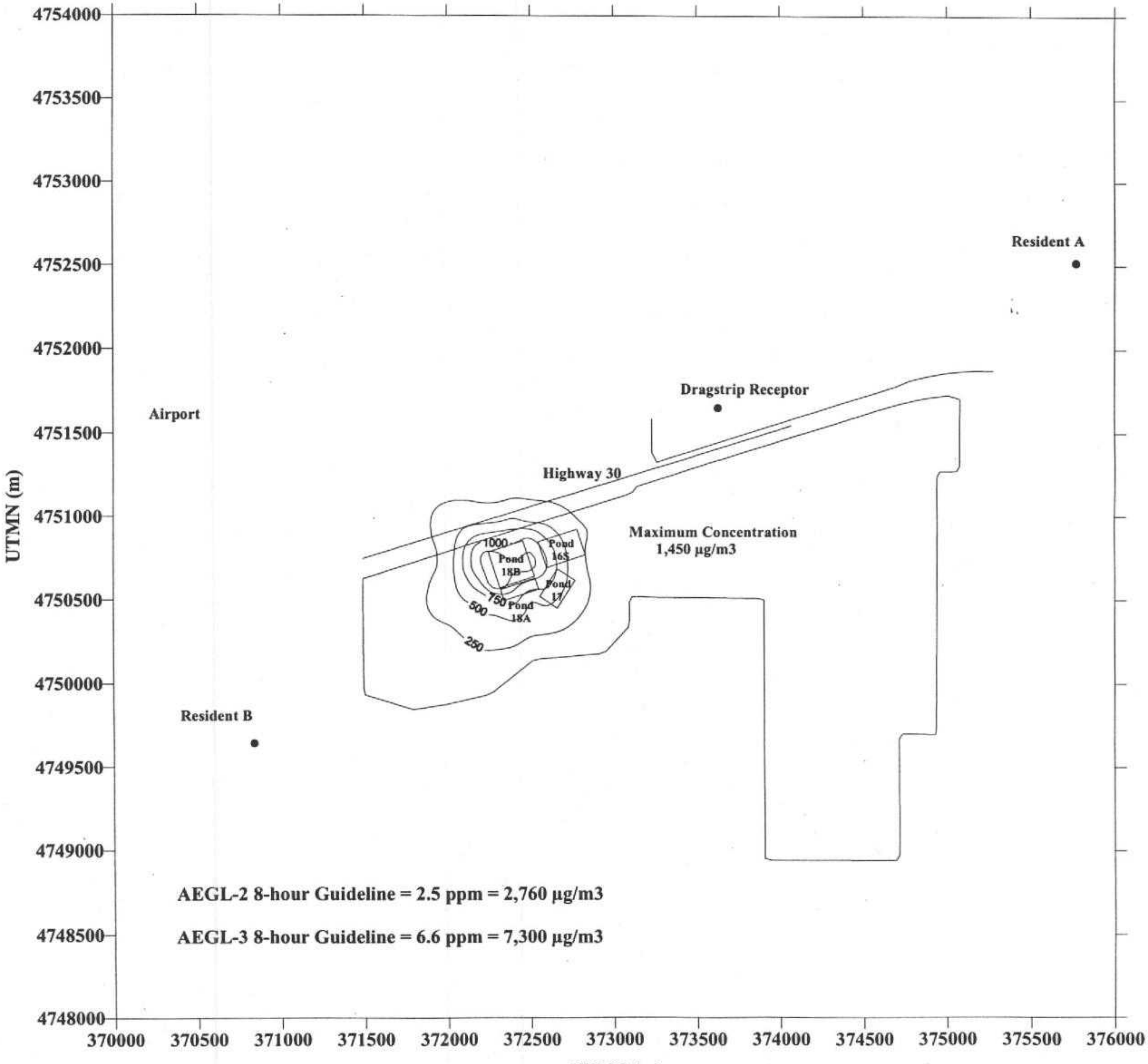

Figure 10. Annual Average HCN Concentrations (Pond 18 Cell B Emissions)

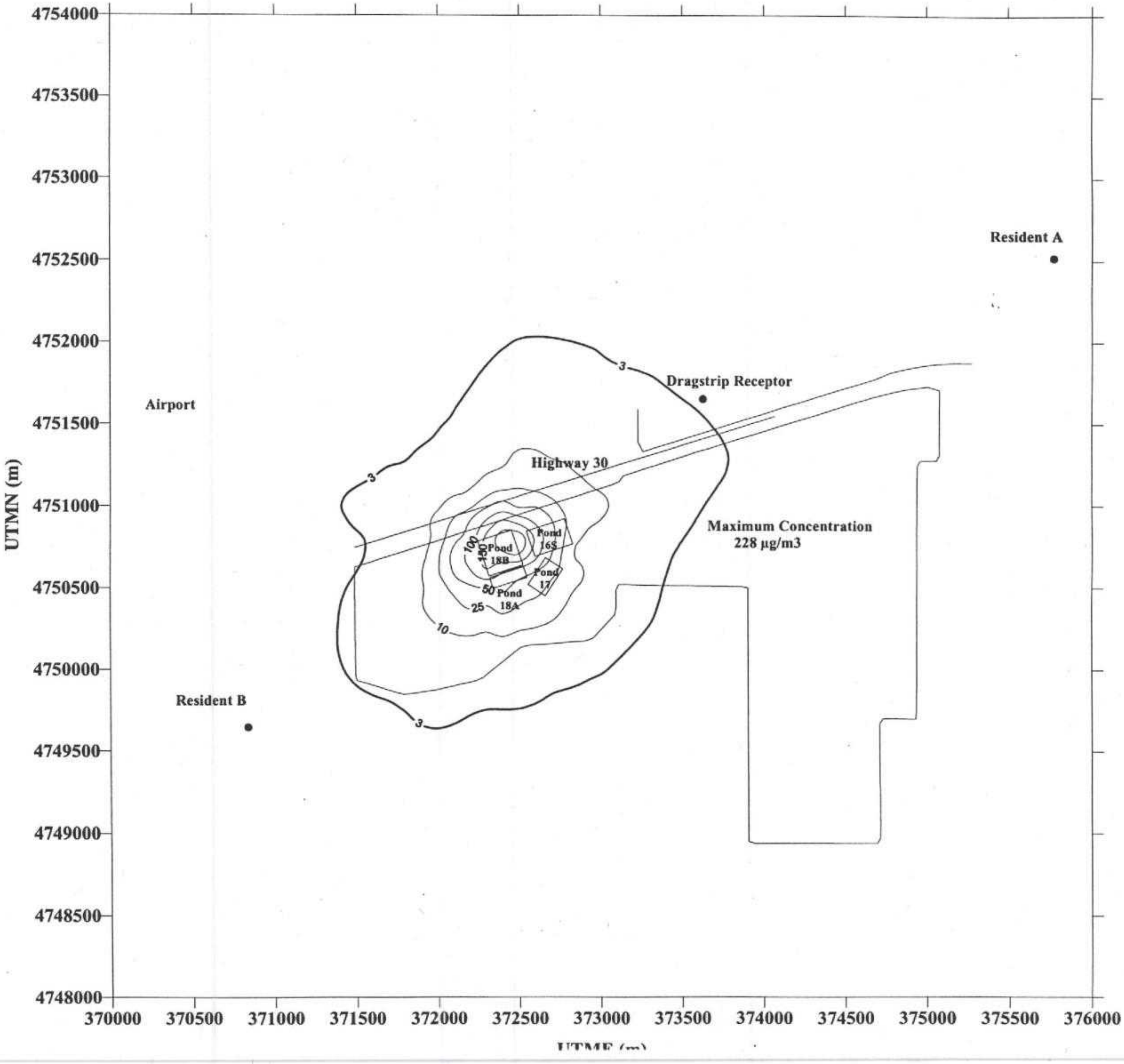

Table 1
Comparison of Maximum Predicted Phosphine Concentration with Health-Based Criteria

Prediction Interval	Predicted Concentration ($\mu g/m^3$)	AEGL-2 Guideline ($\mu g/m^3$)	PEL ($\mu g/m^3$)	Chronic exposure guideline ($\mu g/m^3$)
Maximum 1-hour	118	420	NA	NA
Maximum 4-hour	90	270	NA	NA
Maximum 8-hour	73	180	400	NA
Maximum Annual Average	2.3	NA	NA	0.3

Table 2
Comparison of Maximum Predicted Hydrogen Cyanide Concentration with Health-Based Criteria

Prediction Interval	Predicted Concentration ($\mu g/m^3$)	AEGL-2 Guideline ($\mu g/m^3$)	PEL ($\mu g/m^3$)	Chronic exposure guideline ($\mu g/m^3$)
Maximum 1-hour	2,269	7,800	5,521	NA
Maximum 4-hour	1,665	3,900	5,521	NA
Maximum 8-hour	1,450	2,800	5,521	NA
Maximum Annual Average	228	NA	NA	3.1

3 REFERENCES

Bechtel 1998. RCRA Pond Management Plan. (Consent Decree Attachment) FMC Corporation, Phosphorus Chemical Division. Pocatello, Idaho. September 1998.

Bechtel 1999. RCRA Pond Emission Study Update. FMC Corporation, Phosphorus Chemical Division. Pocatello, Idaho. June 1999.

Bechtel 2000a. Pond 18 Emission Analysis — Potential Phosphine and Hydrogen Cyanide Impacts from 5-Year and 10-Year Sediment Removal Programs. FMC Corporation, Phosphorus Chemical Division. Pocatello, Idaho. January 2000.

Bechtel 2000b. Pond 18 Emission Analysis — Potential Phosphine and Hydrogen Cyanide Impacts from 5-Year and 10-Year Sediment Removal Programs. Supplemental Information. FMC Corporation, Phosphorus Chemical Division. Pocatello, Idaho. January 2000.

U.S. EPA. 2000a. National Advisory Committee for Acute Exposure Guideline Levels (AEGLs) for Hazardous Substances, Proposed [Hydrogen Cyanide] AEGL Values; Notice. Federal Register 65 (51):14186. March 15, 2000.

U.S. EPA 2000b. National Advisory Committee for Acute Exposure Guideline Levels (AEGLs) for Hazardous Substances, Proposed [Phosphine] AEGL Values; Notice. Federal Register 65 (122):3926. June 23, 2000.